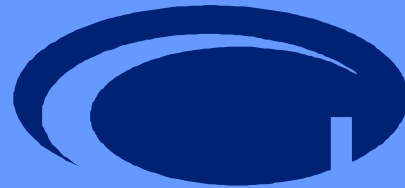# An Operations and Support Model for SEER-H

G A L O R A T H

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ISPA San Antonio

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Overview

The O&S Approach In SEER-H

**How O&S Estimation Folds Into Knowledge Based Estimation**

Describing O&S Scenarios

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Full Integrated Life Cycle Costing

The SEER-H Operations & Support model is fully integrated with development and production estimates

FX-222 Estimate Baseline: Life Cycle Cost Allocation

- Development (11.5%)
- Production (20.2%)
- Operating Site (59.7%)
- Total Equipment Support (8.7%)

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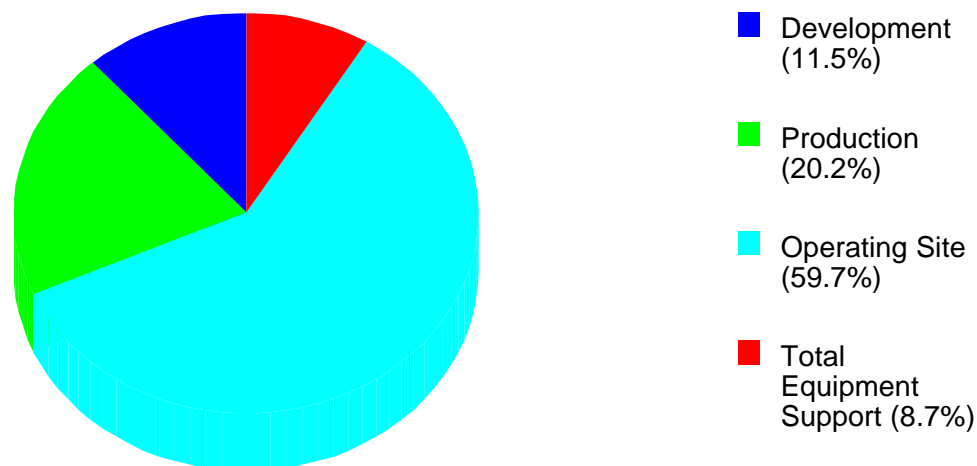
A "Baseline" Flexible, Dynamic Model Allows Modeler To Set Assumptions

Dynamic modeling of fielding, maintenance, support

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Modeling Operations Cost

Concept Of Operations

Work Elements

    1.2 Σ Operational Profiles
      ├ 1.2.1 Long Haul Routes
      └ 1.2.2 Short Haul Routes

Parameters - SITE: Long Haul Routes

+ **OPERATING SITE**		**YES**	
- Number Of Like Sites		1	
- Initial Year Of Operation		**2000**	
- Years Of Operation		**6**	
+ OPERATIONS SCHEDULE	**Systems Fielded & Retired By Year**		
- Phase 1	**1**	**20**	0
- Phase 2	**2**	**30**	0
- Phase 3	**3**	**50**	0
- Phase 4	**4**	0	**20**
- Phase 5	**5**	0	**30**
- Phase 6	**6**	0	**50**
- Phase (Next)	0	0	0
- Utilization	**Usage Rates** 24.00%	33.00%	48.00%
- Operating Personnel Per Unit	1.00	**1.00**	1.00
- Additional Operating Personnel/Year	0.00	0.00	0.00
- Operator Hourly Rate	**60.00**	**60.00**	60.00
- Cost Per Operating Hour	0.00	0.00	0.00
- Cost Per Operating Year	0.00	0.00	0.00

Operations Cost & Personnel Requirements

Operational Hours

Operations Cost

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Modeling Support Cost

Equipment Configuration

Work Elements

- 1.1 Σ Utility Vehicle
  - 1.1.1 Body & Cargo
  - 1.1.2 Drive Train
  - 1.1.3 Engine
  - 1.1.4 Hoses & Cables
  - 1.1.5 Tires
  - 1.1.6 Cargo Lift
  - 1.1.7 Cargo Placement Control
  - 1.1.8 General Control & Processing

Support Concept

Parameters - MECH: Cargo Lift

+ LEVEL 1 SUPPORT		YES	
- Consumable Cost Per Repair	0.00	0.00	0.00
- In Place Repair Rate	0.01%	0.01%	0.01%
- Remove & Replace Time (hours)	1.50	3.00	6.00
- MTTR (hours)	**0.00**	**0.00**	**0.00**
- Condemnation Rate	1.00%	2.00%	3.00%
+ LEVEL 2 SUPPORT		NO	
+ LEVEL 3 SUPPORT		YES	
- Consumable Cost Per Repair	0.00	0.00	0.00
- <<MTTR (hours)>>	10.08	10.08	10.08
- Condemnation Rate	1.00%	1.00%	2.00%
+ Level 3 Support Activity by Site			
- Regional Repair Contractor	100.00%		

Maintenance Activity by Level

Equipment Description

Parameters - MECH: Cargo Lift

+ EQUIPMENT INFORMATION			
- Usage Rate	100.00%	100.00%	100.00%
- <<Mature MTBF (hours)>>	3,224	3,224	3,224
- Scheduled Maintenance Cycle (hours)	80	150	200
- <<Operating Hours to Mature MTBF>>	94	94	94
- Spares Availability		90.00%	
- Spares Lead Time (hours)	72	336	1,008
- <<Equipment Replacement Cost>>	1,830.22	1,830.22	1,830.22
- <<Equipment Material Cost>>	469.20	469.20	469.20
- Retirement Cost Per Unit	0.00	0.00	0.00
- Packing/Shipping Factor	1.10	1.20	1.30
+ Quantity By Operational Site			
- <<Short Haul Routes>>	1	0	
- <<Long Haul Routes>>	1	0	

Reliabilty

Support Cost

Maintenance Demand Rate

Equipment Specific Deployment

Operational Hours

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O&S Model Concept of Operation: Interacting Hardware & Site Elements

Operations-only site

Electrical and mechanical hardware

Multiple-site fielding

Single-site fielding

Interaction between levels 1, 2 and 3 support

Operating and support site

Spares...

Support-only site

Electrical and mechanical hardware elements.   Site elements.

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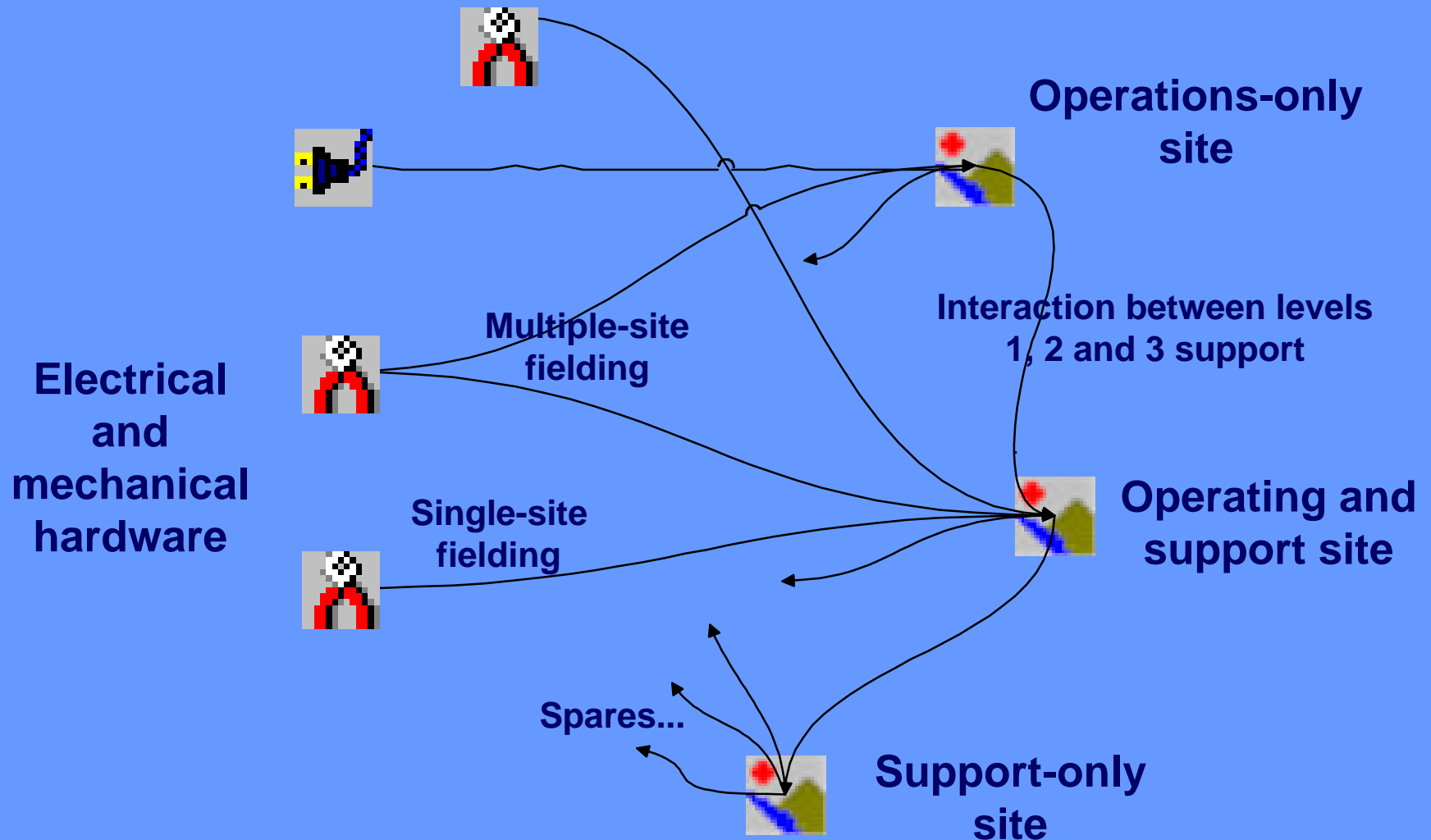
More On The "Site" Element...

Capturing A <u>Logical</u> Rather Than <u>Physical</u> Entity

"Site" elements can be used to separately capture many distinguishing characteristics. They can be combined for a multi-faceted representation of the same physical location!

1 site element for a single "location"...

OR...

Many elements for a single location...
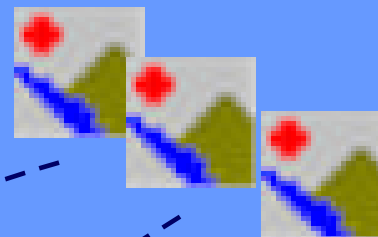
All systems fielded at the site have uniform characteristics. An element can also represent many identical "sites".

Equipment use

At a particular site, you can capture and isolate differences in...

Support arrangements over time

Specific components of O&S costs

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SEER-H with O&S Supports TOC

SEER-H TOC Is Based On 4 Major Cost Components...

Each Cost Component Possesses Its Own Drivers

All Components Are Interdependent

Development Cost
+ Production Cost
+ Operations Cost
+ Support Cost
_____

Total Ownership Cost

Life Cycle Cost Allocation

Radar Site: Life Cycle Cost Allocation

- Development (13.9%)
- Production (25.5%)
- Operating Site (37.8%)
- Total Equipment Support (22.8%)
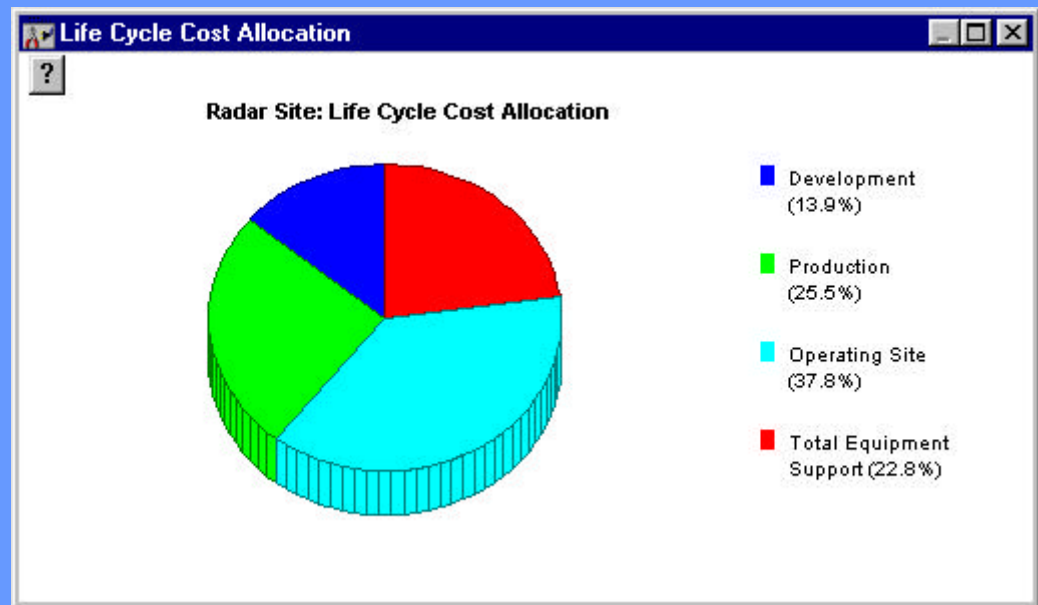
Identifying Cost Drivers

High cost system elements are easily identified

and detail further evaluated

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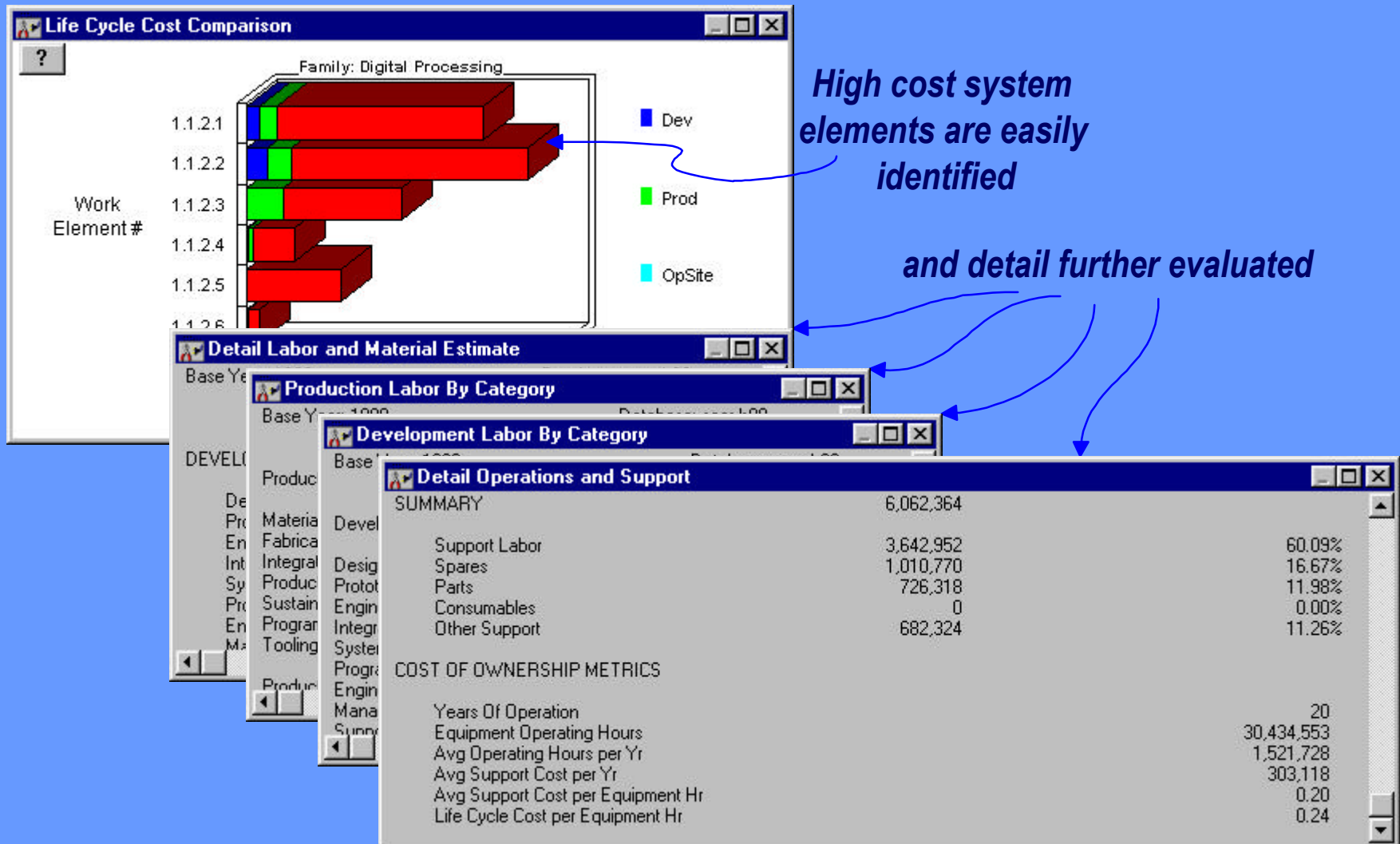
Knowledge-Based Approach

- **The core SEER-H O&S model uses traditional dynamic modeling techniques.**

- **Key drivers can be determined by knowledge base settings:**
  - Support cost drivers
    - **MTBF, MTTR, Ophours To Maturity, Spares Cost, etc.**
  - Operations & support characteristics
    - **Usage Rates, Personnel Requirements, Labor Rates, etc.**

- **Knowledge-based life-cycle cost estimates allow for:**
  - Life-cycle cost estimates at very early conceptual stages
  - Immediate TOC evaluation of design alternatives

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Knowledge-Based Estimates
Embody Risk

Ranges in knowledge based estimates...

Are used to evaluate O&S cost risk
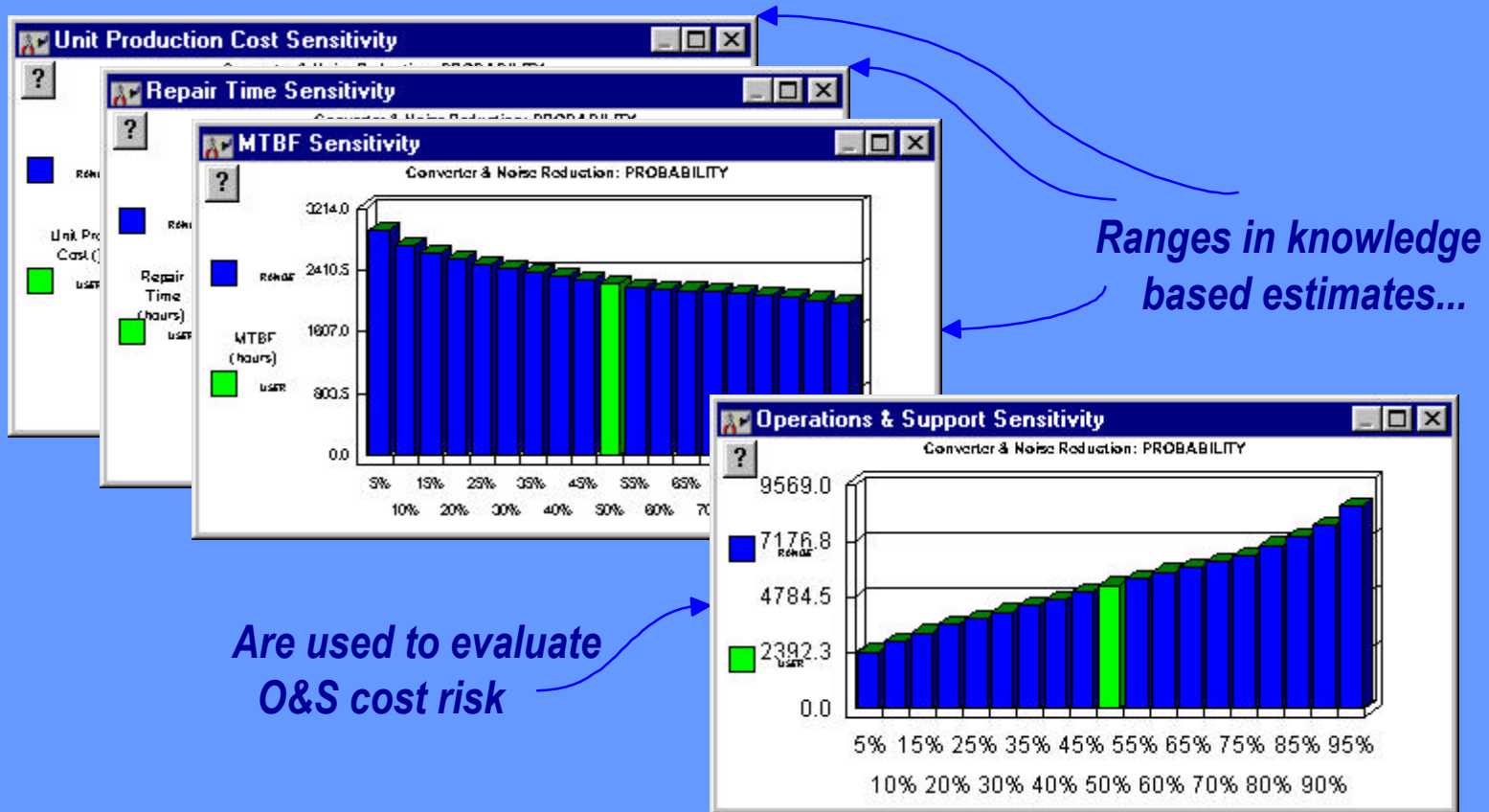
Example… Technology Upgrade of An Embedded Computer

Before

After

Reduced component count increased MTBF, reduced support cost

Use of ASICs increased NRE and parts costs

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Demonstration of SEER-H With O&S Model
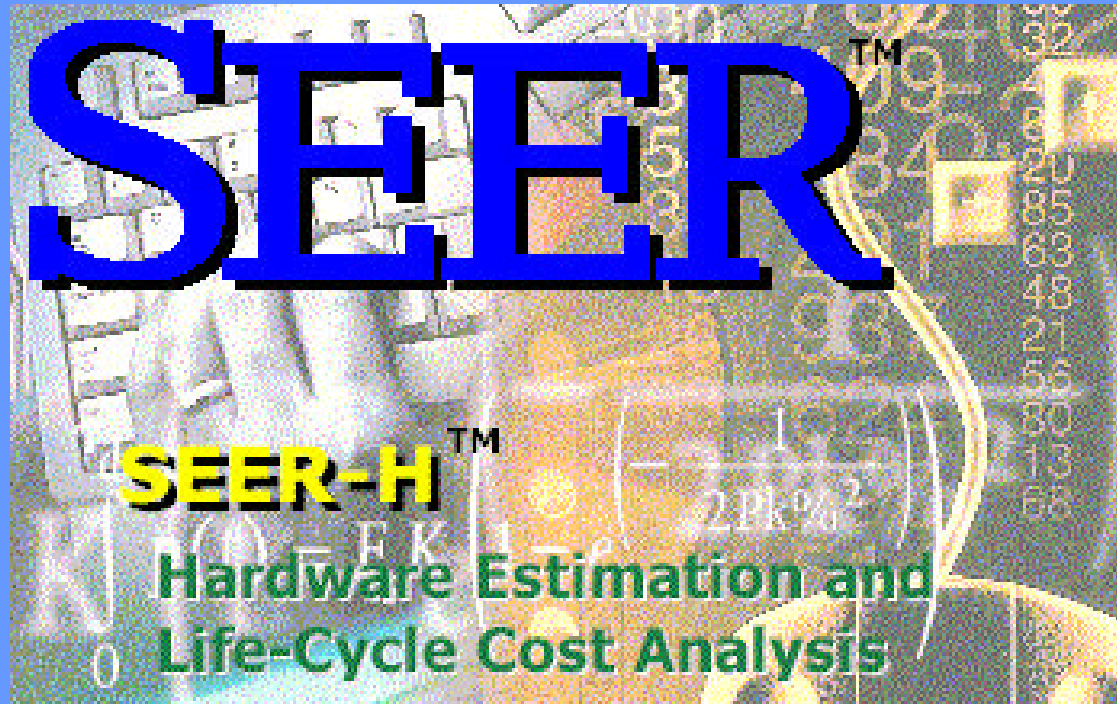
Please see Conference CD for a fully animated demonstration

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Multiple Degrees of Freedom for Highly Flexible O&S Modeling

Unique equipment characteristics

Sustaining engineering & contracted support

Assignment to multiple unique sites

Multiple support levels

Unique site characteristics

System / hardware / logical site assignments

Unique fielding chronology

Each factor can be independently varied

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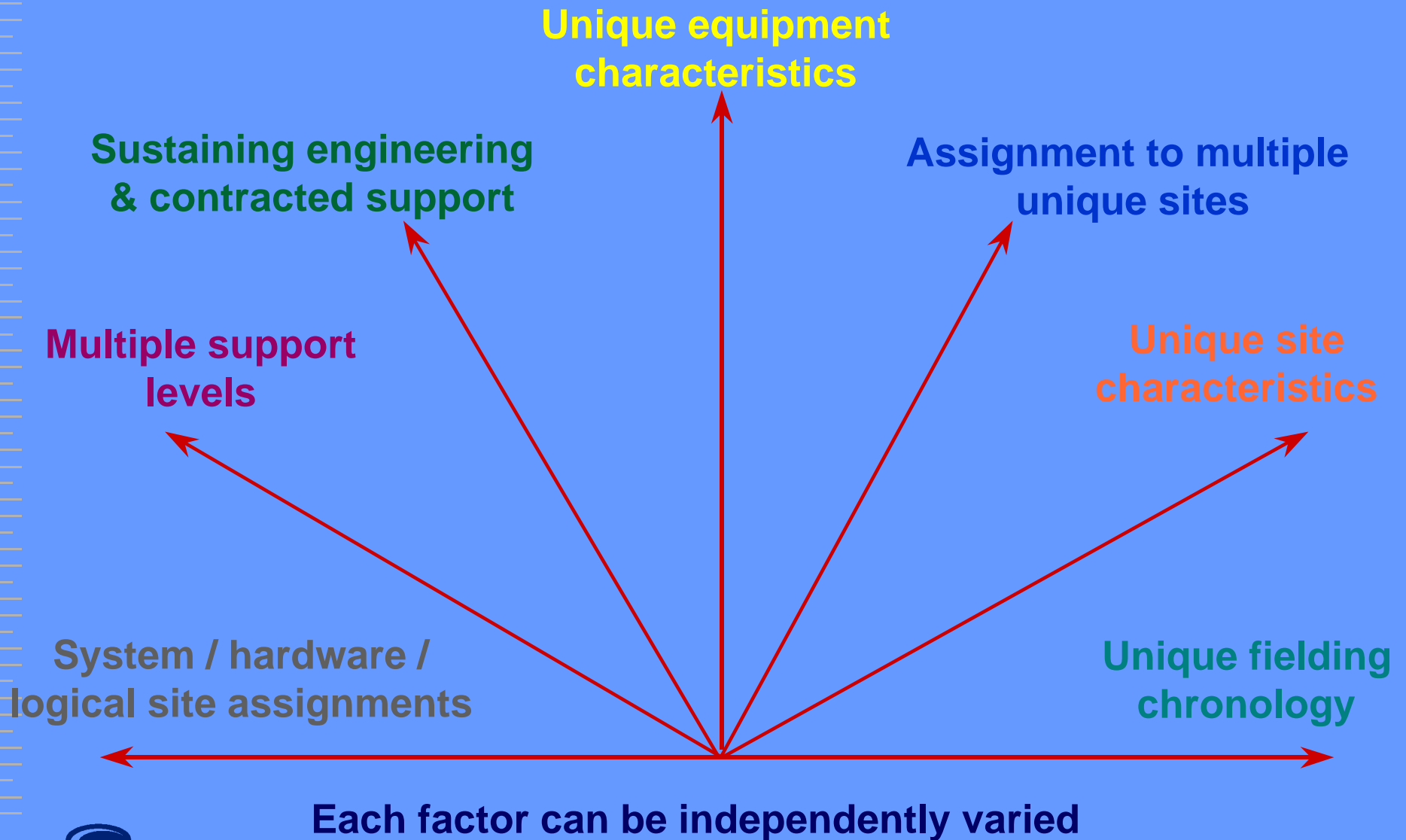
Sample Trade Studies

◆ **What happens if the failure rate is decreased?**

◆ **Should a repair strategy be carried out at the system level, or should there be unique strategies for sub-components?**

◆ **How many tiers of maintenance should there be?**

◆ **Which sites should maintenance be focused at?**

◆ **What happens when fielding is accelerated?**

◆ **Can spares on hand be reduced at the outset of operations?**

◆ **How will changes in equipment utilization change costs?**

◆ **Can contracted support be substituted for organic support?**

SEER-H O&S Modeling Flowchart

Thanks For Coming!

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